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Arhythmorhynchus comptus (Acanthocephala: Polymorphidae) from shorebirds in Patagonia, Argentina, with some comments on a species of *Profilicollis*

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Abstract: Adult and immature *Arhythmorhynchus comptus* (Acanthocephala: Polymorphidae) were found parasitizing the Baird's Sandpiper, *Calidris bairdii*, and the White-rumped Sandpiper, *Calidris fuscicollis* (Aves: Scolopacidae), from several locations in Patagonia, Argentina. This is the first record of *A. comptus* in the southern part of South America and from *C. fuscicollis* and *C. bairdii*, expanding both its geographical and host distribution. Additionally, immature specimens belonging to the genus *Profilicollis* were found in both bird species.

Key words: *Arhythmorhynchus*; *Profilicollis*; *Calidris bairdii*; *Calidris fuscicollis*; range extension; new records

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Shorebirds undertake some of the most spectacular long-distance migrations of any group of birds. These movements initiate in a breeding area and reach a non-breeding area or wintering locality in an area of food abundance (Piersma et al. 1996). These movements make these birds particularly interesting for the international scientific community because of their migratory behavior as well as on their ecology and biology.

In the Argentine region of Patagonia, several shorebird species use different feeding and breeding sites. Some Nearctic migratory birds nest in the northern hemisphere and migrate to Patagonia during the winter. The Baird's Sandpiper, *Calidris bairdii* (Coues, 1861), reproduces in the Arctic tundra in the boreal summer and migrates to the southern hemisphere, reaching Patagonia in the early spring. These migrants remain in Argentina and Chile until the beginning of the austral autumn when they return to the Arctic. They are found in a variety of aquatic environments, from sandy beaches and coastal muddy flats to floodable grasslands and marshes. Their diet is based mainly on insects and their larvae, but also includes worms and spiders (Piersma et al. 1996).

The White-rumped Sandpiper, *Calidris fuscicollis* (Vieillot, 1819), nests from June to August in the central Canadian Arctic, then migrates through central North America, stopping at lakes in Canada. Upon arrival in South America, they migrate through the center of the continent and along its Atlantic coast. They can be seen in Patagonia from March to April on intertidal mudflats, salt marshes, ponds and lagoons. They consume invertebrates such as adult and larval insects, spiders, mollusks, crustaceans, and polychaetes, as well as seeds (Piersma et al. 1996).

The parasitic fauna of migratory birds has been the subject of numerous studies in different parts of the world (e.g., Canaris and Kinsella 2000, 2001, 2007; Canaris et al. 2003; Didyk et al. 2007). However, in South America very little is known about parasites of shorebirds and of seabirds in general. Understanding of parasite life cycles can generate substantial information to understand habitat use and the time spent by the host in a given environment (Bush 1990; Rohde 1993). Studies of the parasitic fauna of these two phylogenetically related species of migratory birds could be an important contribution to ecological and biogeographical studies.

The aim of this paper is to expand the taxonomic and ecological knowledge about helminths of birds associated with wetlands in Argentina. Here we provide new morphological details on *Arhythmorhynchus comptus* Van Cleave & Rausch, 1950 based on specimens recovered from Baird's Sandpiper, *C. bairdii*, and the White-rumped Sandpiper, *C. fuscicollis*, from Patagonia, Argentina, expanding its geographical and host distribution. Additionally, we report immature specimens belonging to the genus *Profilicollis* Mayer, 1931 found in both bird species.

A total of 44 *C. bairdii* and 48 *C. fuscicollis* were

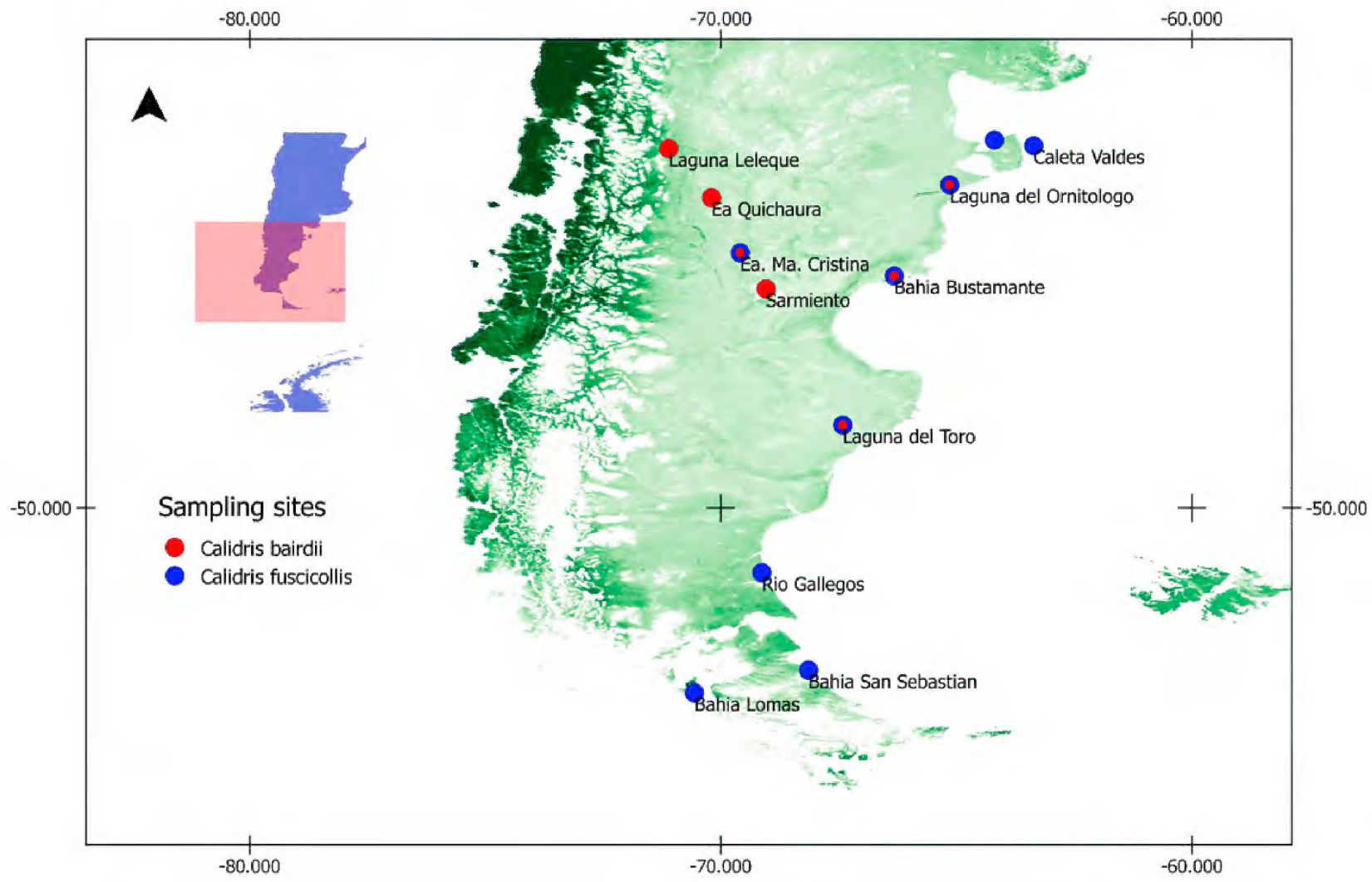


Figure 1. Map of Patagonia, the dots show sampling locations (datum used for geographic coordinates: EPSG: 22185).

occasionally found dead or died of accidents during captures (permits number 19/04, 02/05, 10/6, 02/08, 48/08 DF and FS Chubut), or were collected during other research projects (permits number 406/05 DFS Santa Cruz province, and number 92/05 DF and FS Chubut Province) during January 1999, 2005 and 2006. Samples of hosts were examined from locations in both marine and freshwater environments (Figure 1).

Hosts were dissected in the field and viscera were fixed in 10% formalin. In the laboratory, acanthocephalans were recovered from the intestine and preserved in 70% ethanol. Some specimens were not relaxed before fixation and therefore not all had proboscises fully everted. For morphological study, specimens were studied in temporary mounts of lactophenol or eugenol using an Olympus BX51® microscope (OM). Some male specimens were dissected to a better observation of the cement glands. Several specimens were dried using the critical point method, examined by scanning electron microscopy (SEM) (Jeol 6360LV®, Tokio, Japan), and photographed. Drawings were made with the aid of a camera lucida. Measurements are given in micrometers unless otherwise indicated as the range followed by parentheses. Eggs were measured through the body wall. For taxonomic identification, acanthocephalans were analyzed following specific bibliography (Van Cleave 1916; Van Cleave and Rausch 1950; Yamaguti 1963; McDonald 1988). The prevalence (P) and mean intensity (MI) were calculated following Bush et al. (1997).

Voucher specimens were deposited in the Colección Helmintológica del Museo de La Plata, Buenos Aires, Argentina, and in the Parasitological Collection of the Centro Nacional Patagónico, Puerto Madryn, Argentina.

A total of 29 adult acanthocephalans were found attached to the intestine wall of *C. bairdii* (*n* = 21) and *C. fuscicollis* (*n* = 8). Ten immature specimens were also recovered, nine from *C. bairdii* and only one in *C. fuscicollis*. Morphometric and morphological characteristics of adults allowed identification as *A. comptus*. Immature specimens were identified either as *A. comptus* or *Profilicollis* sp.

Arhythmorhynchus comptus Van Cleave & Rausch, 1950 (Figures 2–5; Table 1): Polymorphida Petrochenko, 1956; Polymorphidae Meyer, 1931; Sphaerechinorhynchinae Golvan, 1960. *Arhythmorhynchus* Lühe, 1911.

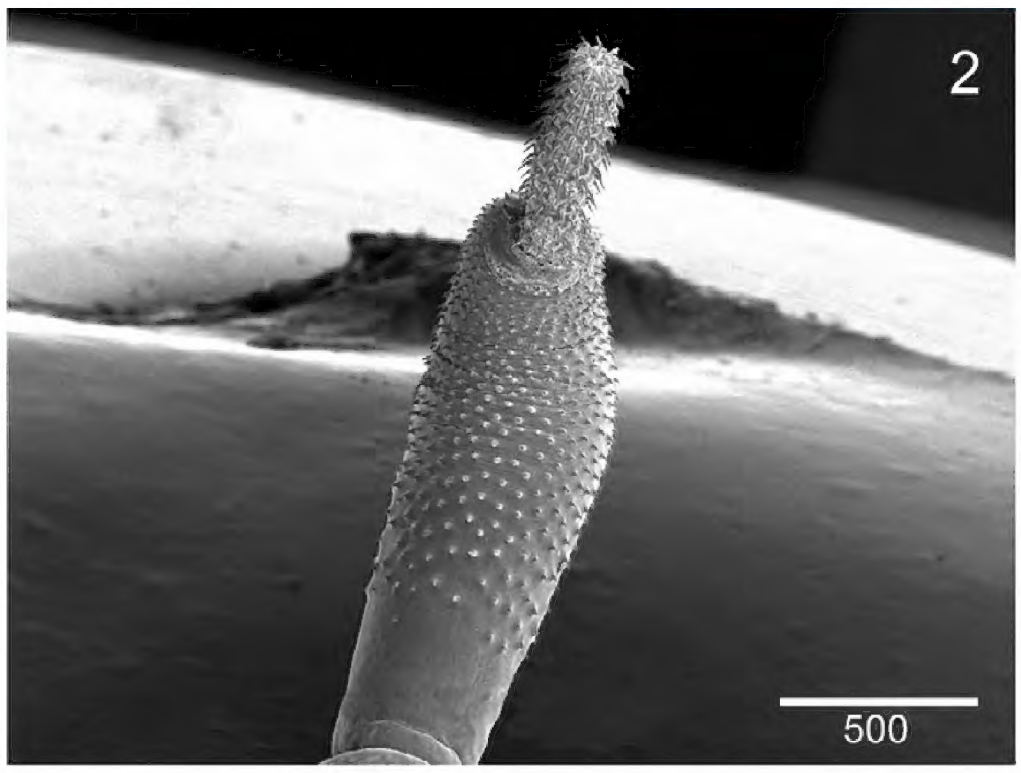
New hosts: Baird's Sandpiper, *Calidris bairdii* (Coues, 1861); White-rumped Sandpiper, *Calidris fuscicollis* (Vieillot, 1819).

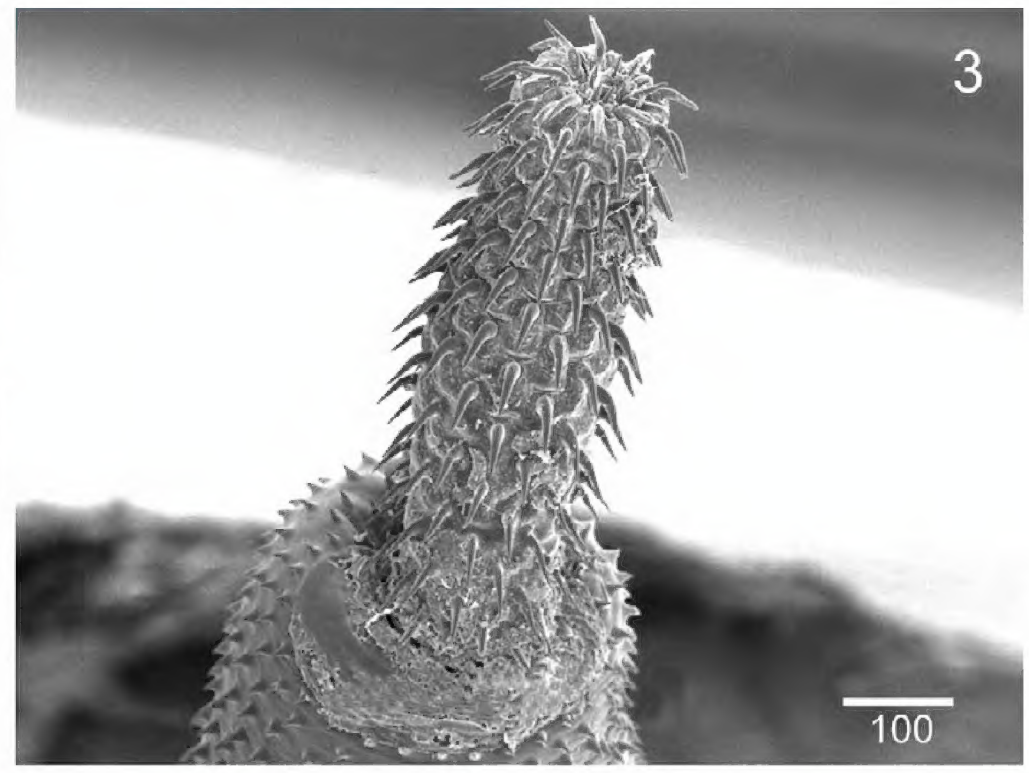
New localities: Laguna del Toro (48°24′ S, 067°41′ W), Laguna del Ornitólogo (43°14′ S, 065°14′ W), Bahía Bustamante (45°07′34″ S, 066°32′14″ W), San José Gulf (42°19′5″ S, 064°19′5″ W), Laguna Leleque (42°37′45″ S, 071°11′ W), Estancia Quichaura (43°42′ S, 070°02′ W), Estancia Maria Cristina (44°58′14″ S, 069°59′30″ W).

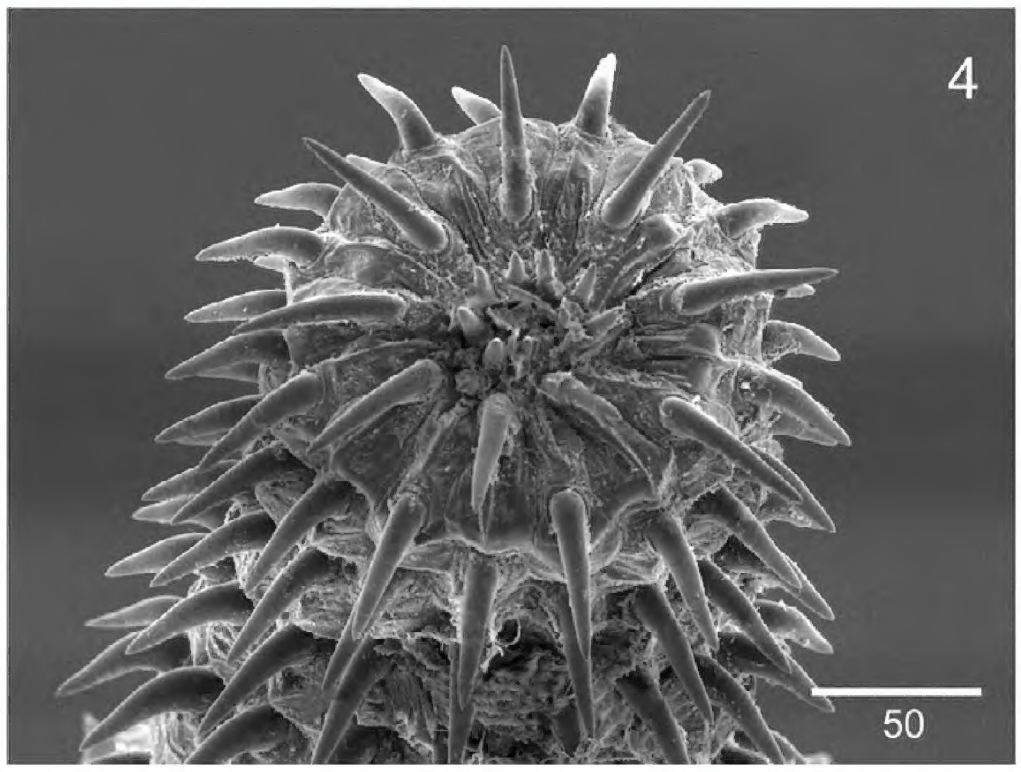
Site of infection: intestine

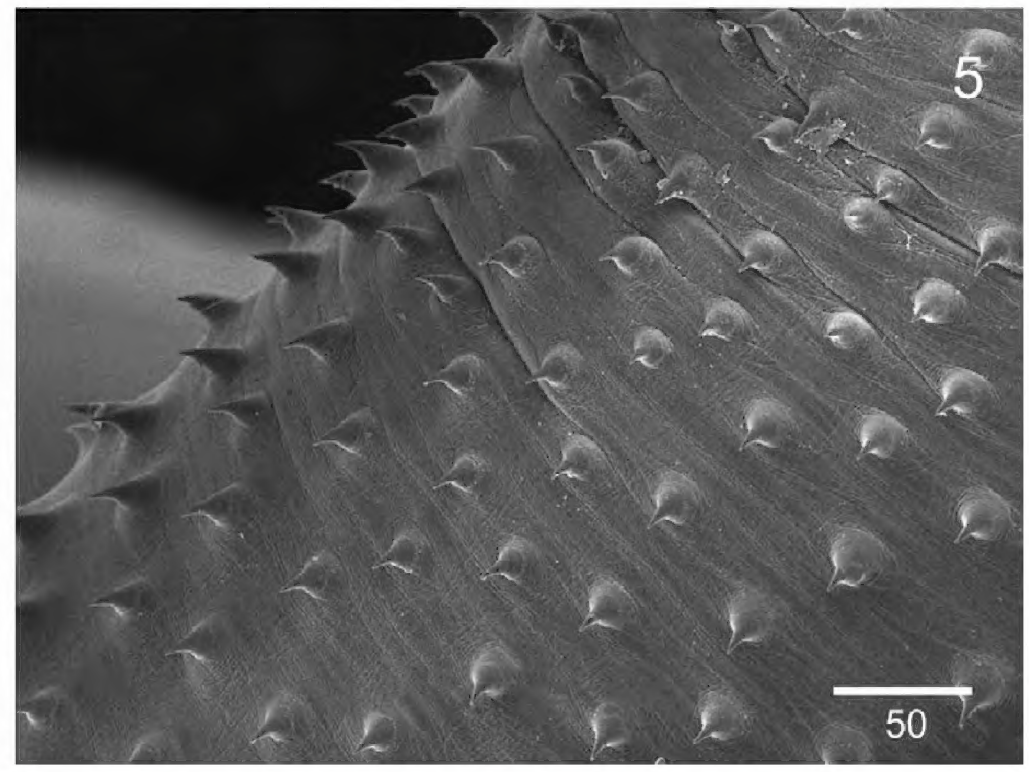
P and MI = 27% and 1.75 in *C. bairdii*; 8.3% and 2 in *C. fuscicollis*.

Adult specimens — General: Body very long and narrow. Anterior trunk covered by spines in a small area, limited to that region. In the first part, the trunk is widened, then it thins and finally wides again towards the end of the body. Cylindrical posterior portion of the trunk sometimes invaginated in the anterior portion.









Figures 2–5. *Arhythmorhynchus comptus* from *Calidris bairdii* and *Calidris fuscicollis* from Argentina. **2**: General view of *A. comptus*. **3**: Proboscis. **4**: Proboscis hooks. **5**: Anterior body spines.

The proboscis is always swollen medially with 16 or 17 longitudinal rows of hooks, each row with 11 hooks. Hooks longer at the swollen level of the proboscis (45–54). Most proboscis hooks appear to have weak roots. Those of the middle of the proboscis are well rooted (roots: 10–15 long). Receptacle of the proboscis double-walled and cylindrical with ganglia in the middle. Lemnisci narrow. Testes in tandem in the wide posterior region forward to the spinous region. Two number of cement glands. Elliptical eggs with polar extensions of the middle cover.

Immature specimens — Trunk length: 900–1270 (1085), maximum width: 300–500 (396). Proboscis length: 230–350 (280), width 150–250 (187). Proboscis with 14 to 16 rows of hooks and 6–7 hooks per row. The proboscis hooks length: 40–50 (42) long. Spines along the trunk: 20–30 (25) long. In almost all specimens neck length could not be observed due to being inside the trunk. Length of the proboscis receptacle 280–550 (473), width: 60–150 (121).

Host: *Calidris bairdii*.

Localities: Estancia María Cristina (44°58′14″ S, 069°59′30″W) and Bahia Bustamante (45°07′34″ S, 066°32′14″ W), Chubut province, Argentina.

Voucher specimens MLP He 7118, 7119, 7120, 7121, CNP-Par-135 y 136.

Measurements of males and females, of *A. comptus* are shown in Table 1.

***Profilicollis* sp. immature specimens** (Figure 6)

Undeveloped reproductive organs were observed. Short and stocky trunk. Length: 1500–2750 (1987), maximum width: 700–1000 (825). Length of proboscis 600–700 (650), width 400–500 (450). Proboscis with 16–20 rows of hooks and 7–8 rows of hooks per row. Length of proboscis hooks: 50. Length of trunk spines: 20–50 (31). Neck long: 600–1800 (975), width: 300; length of the proboscis receptacle 450–800 (675), width: 200–300 (250).

Hosts: *Calidris bairdii* and *Calidris fuscicollis*.

Locality: Bahía Bustamante (45°07′34″ S, 066°32′14″ W), Chubut province, Argentina.

Table 1. Comparative measurements of Arhythmorhynchus spp. from different hosts and localities. References: L (length), W (width)

Host species	***Calidris ptilocnemis couesi/Calidris alpina pacifica/Aphriza virgata/ Numenius americanus***	***Calidris bairdii***	***Calidris fuscicollis***
Distribution	Alaska	Ea. Ma. Cristina/Ea Quichaura/ B. Bustamante/ Lag. Leleque	Lag. del Toro/B. Bustamante/ San José Gulf/ Lag. del Ornitólogo
References	Van Cleave & Rausch, 1950	Present study	Present study
Males (n)	—	**4**	**3**
Total L	23–32 mm	13–28.4 (20.6) mm	19.1–21.6 (20.4) mm
Total W	635–807	400–700 (513)	500
Proboscis L	320–440	410–500 (453)	450–550 (483)
Proboscis W	170–240	130–200 (183)	120–200 (178)
Proboscis receptacle L	—	700–1300 (1030)	700–1300
Proboscis receptacle W	—	150–500 (288)	120–200 (207)
Row of hooks	15–16	16–17	16–17
Hooks per row	8–9	11–12	11–12
Hooks L	44–48	0.040–0.053 (0.053)	0.040–0.046 (0.042)
Neck L	350–750	325	100–250 (167)
Neck W	—	300	120–200 (173)
Body spines L	15	20–30 (25)	25–40 (33)
Body spines W	15–20	20–40 (30)	20–25 (21.6)
Lemnisci L	1.2–1.8 mm	700–1300 (1030)	1.1–1.85 (1.38) mm
Anterior testis L	1–1.5 mm	370–1100 (668)	300–850 (575)
Anterior testis W	—	140–350 (248)	200–250 (225)
Distance from spiny area	2–3 mm	1.11–3.0 mm	1.4–2.1 mm
Posterior testis L	1–1.5 mm	550–1200 (738)	320–1000 (660)
Posterior testis W	—	190–350 (260)	200–220 (210)
Cement glands L	13–24 mm	12.4–23.1 (14.9) mm	14.1 mm
***Females* (n)**		**4**	**3**
Total L	40–55 mm	17.700–32.65 (25.013) mm	26.95–30.2 (28.36) mm
Total W	800–1000	450–950 (613)	480–600 (527)
Proboscis L	430–480	400–750 (600)	450–600 (517)
Proboscis W	250–400	160–190 (150)	200
Proboscis receptacle L	—	1.290–1.75 (1.455) mm	1–1.7 (1.28) mm
Proboscis receptacle W	—	100–300 (213)	200–250 (217)
Row of hooks	15 –16	16–17	16–17
Hooks per row	8 –9	11–12	11–12
Hooks L	—	0.042–0.050 (0.045)	0.045–0.060 (0.054)
Neck L	460–800	250–280 (265)	100–300 (158)
Neck W	—	200–370 (285)	200–350 (283)
Body spines L	—	20–30 (27)	20–35 (25)
Body spines W	—	15–25(20)	20–25 (22)
Lemnisci L	—	1.3–2.1 (1.7) mm	1.1–1.2 (1.15) mm
Eggs	93–101 × 22–26	90–100 × 20–25	90–100 × 20–25

Voucher specimens MLP He 7116, 7117 and CNP 137.

Morphometric and morphologic characteristics of adult acanthocephalans studied here enable them to be identified as *A. comptus*. However, slight differences in measurements of some features from those recorded by previous authors were observed (e.g., total length of female, neck length, body spine length, number of hook per row) (see Table 1). In present specimens it could be observed a great number of hooks per row than those observed by Van Cleave and Rausch (1950). The present specimens show some similarities to *Arhythmorhynchus capellae* (Yamaguti, 1935) and *Arhythmorhynchus eroliae* (Yamaguti, 1939). However, the two latter species have larger number of rows and hooks per row than *A. camptus*, which has the lowest number of hooks per row in the genus. Although there are other reports of *A. comptus*, authors did not provide morphometric data (e.g., Canaris and Kinsella 2007) that could be compared with the present specimens.

There are discrepancies in the number of cement glands in this species and in others of the genus (Golvan 1960; Yamaguti 1963). However, the observation of such structures is quiet difficult due to the thickness of the body wall. We observed only two cement glands after the dissection of some males. According to Van Cleave and Rausch (1950), *A. comptus* is the only species of the genus with two cement glands.

Members of the genus have been recorded previously in North and Central America in birds of the family Scolopacidae. In Alaska *A. eroliae* was reported from the Ruddy Turnstone *Arenaria interpres* (Linnaeus, 1758) (Canaris and Kinsella 2007), and *A. longicollis* (Villot,

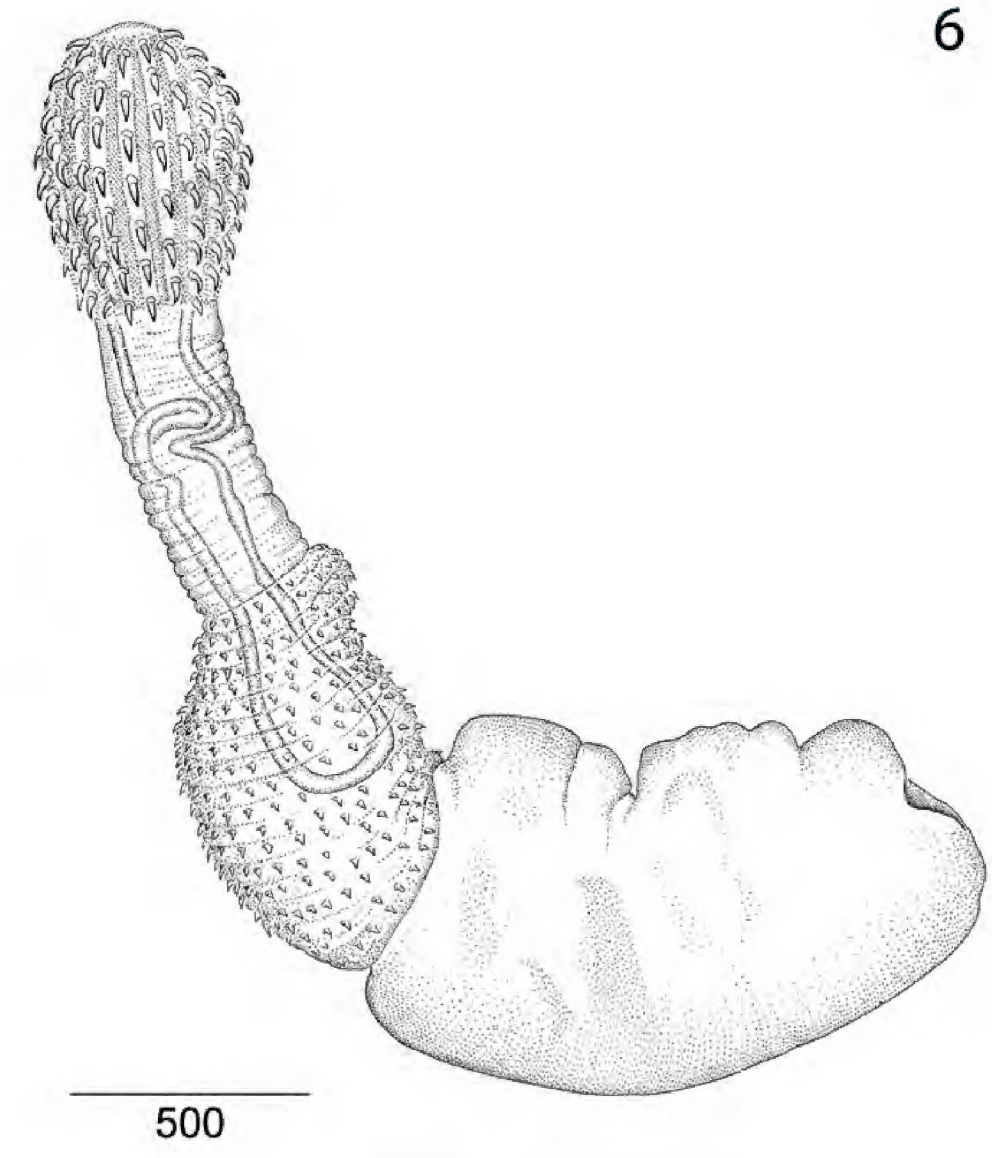


Figure 6. *Profilicollis* sp. Immature specimen from *Calidris bairdii* and *Calidris fuscicollis* from Argentina.

1875) in the Ruddy Turnstone and White-rumped Sandpiper in Belize (Canaris and Kinsella 2001). This last two acanthocephalan species can also be distinguished from *A. comptus* by the number and distribution of the proboscis hooks (see Table 1).

This is the first record of *A. comptus* from both *C. bairdii* and *C. fuscicollis* as well as the first record in any host from South America.

The genus *Profilicollis* includes nine valid species of which only four occur in South America (Amin 2013). *Profilicollis sphaerocephalus* Van Cleave, 1947 has been recorded in Uruguay and South Australia (Zdzitowiecki 1985), *Profilicollis antarcticus* Zdzitowiecki, 1985 was recorded in the South Shetland Islands (Zdzitowiecki 1985), Chile Islands (Pulgar et al. 1995), New Zealand (Brockerhoff and Smales 2002), and Patagonia (Kreiter and Semenas 1997). *Profilicollis altmani* (Perry, 1942) has been recorded in Perú (Tantaleán and Cárdenas 2004) and Chile (Oliva et al. 2008). Finally, *Profilicollis chasmagnathi* (Holcman-Spector, Mane-Garzon & Dei-Cas, 1978) was recorded in Brazil (Yamaguti 1963), Uruguay (Cordero 1933) and Argentina (Martorelli 1989; Vizcaino 1989; Diaz 2006, La Sala and Martorelli 2007; Diaz et al. 2011). Because no adults were found, it was not possible to identify the specimens to species level. However, based on the number and distribution of hooks on the proboscis and previous reports in the area (i.e., South Atlantic coast), it is probable that they are *P. chasmagnathi*. However, further experimental or molecular studies are needed to confirm this hypothesis and to corroborate the identity of the species.

Baird's and White-rumped sandpipers breed in the high Arctic and migrate extremely long distances to winter in the southern cone of South America (Chandler 2009). The birds arrive in northern South America around early October and to their wintering areas (e.g., Patagonia Argentina) about a month later. According to Atrashkevich (1979), the life cycle of *A. comptus* includes freshwater isopods as intermediate hosts. Development from the infective cystacanth to the adult acanthocephalan takes around 30–49 days (Atrashkevich 1979). Because both adults and juveniles were found in birds from Patagonia collected in January, then infections were acquired in South America during the fall migration. Future studies are needed to show whether the life cycle can also be completed on the wintering grounds.

Previous to this work, there have been few records of parasites in these two Nearctic migratory shorebirds species in southernmost South America. They included the nematodes *Echinuria skrjabiniensis* Efimov *in* Skrjabin, Sobolev & Ivashkin, 1965 (Acuariidae) from *C. bairdii* and *C. fuscicollis*, and *Tetrameres megaphasmidiata* Cremonte, Digiani, Bala & Navone, 2001 (Tetrameridae) in *C. fuscicollis* both from Patagonia, Argentina (Cremonte et al. 2001; Diaz et al. 2011).

The present report increases the knowledge of acanthocephalans of migratory birds and represents the first record of *A. comptus* in South America and from *C. fuscicollis* and *C. bairdii*, expanding both the geographical and host distribution.

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